

W, *encl*
1 Kevin G. Donohoe as inventors, and which is now U.S. Patent No. ____
2 _____, the disclosure of which is incorporated by reference.

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4 At page 7, line 23 before "conducted" insert --is--.

5
6 In the Claims:

7 Cancel claims 8, 9, 14, 15, 29, 43, 51 and 52 without prejudice.

8
9 Pending Claims 1-7, 10-13, 16-28, 30-42, 44-50 and 53-57 are
10 presented hereinbelow for the Examiner's benefit.

11
12 1. A plasma etching method comprising:
13 forming a polymer comprising carbon and a halogen over at least
14 some internal surfaces of a plasma etch chamber; and
15 after forming the polymer, plasma etching using a gas effective to
16 etch polymer from chamber internal surfaces; the gas having a hydrogen
17 component effective to form a gaseous hydrogen halide from halogen
18 liberated from the polymer.

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20 2. The plasma etching method of claim 1 wherein the halogen
21 is selected from the group consisting of fluorine, chlorine and mixtures
22 thereof.
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1 3. The plasma etching method of claim 1 wherein the halogen
2 comprises fluorine.

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4 4. The plasma etching method of claim 1 wherein the gas also
5 comprises an oxygen component.

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7 5. The plasma etching method of claim 1 wherein the gas also
8 comprises O₂.

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10 6. The plasma etching method of claim 1 wherein the hydrogen
11 component comprises NH₃.

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13 7. The plasma etching method of claim 1 wherein the hydrogen
14 component comprises H₂.

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16 10. A plasma etching method comprising:
17 forming a polymer comprising carbon and a halogen over at least
18 some internal surfaces of a plasma etch chamber; and
19 after forming the polymer, plasma etching using a gas effective to
20 etch polymer from chamber internal surfaces; the gas comprising a
21 carbon compound effective to getter the halogen from the etched
22 polymer.
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1 11. The plasma etching method of claim 10 wherein the gettering
2 comprises forming a gaseous hydrogen halide from the etched halogen.
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4 12. The plasma etching method of claim 10 wherein the gettering
5 comprises forming a gaseous COA_x compound, where A is the etched
6 halogen.
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8 13. The plasma etching method of claim 10 wherein the carbon
9 compound comprises a hydrocarbon.
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11 16. The plasma etching method of claim 10 wherein the carbon
12 compound comprises a C-O bond.
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14 17. The plasma etching method of claim 10 wherein the carbon
15 compound comprises CO.
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17 18. The plasma etching method of claim 10 wherein the carbon
18 compound comprises CO formed from CO_2 injected into the chamber.
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20 19. The plasma etching method of claim 10 wherein the halogen
21 comprises fluorine.
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1 20. The plasma etching method of claim 10 wherein the gas also
2 comprises an oxygen component.

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4 21. A plasma etching method comprising:
5 positioning a semiconductor wafer on a wafer receiver within a
6 plasma etch chamber;

7 first plasma etching material on the semiconductor wafer with a
8 gas comprising carbon and a halogen, a polymer comprising carbon and
9 the halogen forming over at least some internal surfaces of the plasma
10 etch chamber during the first plasma etching; and

11 after the first plasma etching and with the wafer on the wafer
12 receiver, second plasma etching using a gas effective to etch polymer
13 from chamber internal surfaces and getter halogen liberated from the
14 polymer to restrict further etching of the material on the semiconductor
15 wafer during the second plasma etching.

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17 22. The plasma etching method of claim 21 wherein the receiver
18 is biased during the first plasma etching and provided at ground or
19 floating potential during the second plasma etching.

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21 23. The plasma etching method of claim 21 wherein the gas
22 comprises hydrogen which combines with the halogen during the second
23 plasma etching to form a gaseous hydrogen halide.

1 24. The plasma etching method of claim 21 wherein the second
2 etching is conducted with a temperature of the receiver provided at from
3 about -10°C to about 40°C and at a chamber pressure of from about 30
4 mTorr to about 5 Torr.

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6 25. The plasma etching method of claim 21 wherein the halogen
7 comprises fluorine.

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9 26. The plasma etching method of claim 21 wherein the gas
10 comprises an oxygen component.

11
12 27. The plasma etching method of claim 21 wherein the gas
13 comprises NH_3 , with hydrogen from the NH_3 combining with the halogen
14 during the second plasma etching to form a gaseous hydrogen halide.

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16 28. The plasma etching method of claim 21 wherein the gas
17 comprises H_2 which combines with the halogen during the second plasma
18 etching to form a gaseous hydrogen halide.

1 30. The plasma etching method of claim 21 wherein the first and
2 second plasma etchings are conducted at subatmospheric pressure, and
3 the wafer remaining *in situ* on the receiver intermediate the first and
4 second etchings, and maintaining the chamber at a subatmospheric
5 pressure at all time intermediate the first and second plasma etchings.
6

7 31. The plasma etching method of claim 21 wherein the gettering
8 comprises forming a gaseous COA_x compound, where A is the etched
9 halogen.
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11 32. The plasma etching method of claim 21 wherein the gas
12 comprises a carbon compound effective for the gettering.
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14 33. The plasma etching method of claim 32 wherein the carbon
15 compound comprises a hydrocarbon.
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17 34. The plasma etching method of claim 32 wherein the carbon
18 compound comprises a C-O bond.
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20 35. The plasma etching method of claim 32 wherein the carbon
21 compound comprises CO.
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1 36. A plasma etching method comprising:
2 positioning a semiconductor wafer on a wafer receiver within a
3 plasma etch chamber, the semiconductor wafer having a photoresist layer
4 formed thereon;

5 first plasma etching material on the semiconductor wafer through
6 openings formed in the photoresist layer with a gas comprising carbon
7 and a halogen, a polymer comprising carbon and the halogen forming
8 over at least some internal surfaces of the plasma etch chamber during
9 the first plasma etching; and

10 after the first plasma etching and with the wafer on the wafer
11 receiver, second plasma etching using a gas having one or more
12 components effective to etch photoresist from the substrate and polymer
13 from chamber internal surfaces and getter halogen liberated from the
14 polymer to restrict further etching of the material on the semiconductor
15 wafer during the second plasma etching.

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17 37. The plasma etching method of claim 36 one of the gas
18 components comprises hydrogen which combines with the halogen during
19 the second plasma etching to form a gaseous hydrogen halide.

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21 38. The plasma etching method of claim 36 wherein one of the
22 gas components comprises O_2 and another is hydrogen atom containing.
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1 39. The plasma etching method of claim 36 wherein one of the
2 gas components comprises O_2 and another is hydrogen atom containing,
3 said one component and said another component being provided in the
4 chamber during the second plasma etching at a volumetric ratio of the
5 one to the another of at least 0.1:1.

6
7 40. The plasma etching method of claim 36 wherein the halogen
8 comprises fluorine.

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10 41. The plasma etching method of claim 36 wherein one of the
11 gas components comprises NH_3 , with hydrogen from the NH_3 combining
12 with the halogen during the second plasma etching to form a gaseous
13 hydrogen halide.

14
15 42. The plasma etching method of claim 36 wherein one of the
16 gas components comprises H_2 which combines with the halogen during
17 the second plasma etching to form a gaseous hydrogen halide.

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19 44. The plasma etching method of claim 36 wherein the first and
20 second plasma etchings are conducted at subatmospheric pressure, and
21 the wafer remaining *in situ* on the receiver intermediate the first and
22 second etchings, and maintaining the chamber at a subatmospheric
23 pressure at all time intermediate the first and second plasma etchings.

1 45. The plasma etching method of claim 36 wherein the gettering
2 comprises forming a gaseous COA_x compound, where A is the etched
3 halogen.
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5 46. The plasma etching method of claim 36 wherein the gas
6 comprises a carbon compound effective for the gettering.
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1 47. A plasma etching method comprising:
2 positioning a semiconductor wafer on an electrostatic chuck within
3 an inductively coupled plasma etch chamber, the semiconductor wafer
4 having a photoresist layer formed on an insulative oxide layer, the
5 photoresist layer having contact opening patterns formed therethrough;

6 first plasma etching contact openings within the insulative oxide on
7 the semiconductor wafer through the contact opening patterns formed in
8 the photoresist layer with a gas comprising carbon and fluorine, a
9 polymer comprising carbon and fluorine forming over at least some
10 internal surfaces of the plasma etch chamber during the first plasma
11 etching; and

12 after the first plasma etching and with the wafer on the
13 electrostatic chuck, providing the electrostatic chuck at ground or floating
14 potential while second plasma etching using a gas comprising an oxygen
15 component and a hydrogen component effective to etch photoresist from
16 the substrate and polymer from chamber internal surfaces, and forming
17 HF during the second plasma etching from fluorine liberated from the
18 polymer to restrict widening of the contact openings formed in the
19 insulative oxide resulting from further etching of the material on the
20 semiconductor wafer during the second plasma etching.

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22 48. The plasma etching method of claim 47 wherein the oxygen
23 comprises O₂.

1 49. The plasma etching method of claim 47 wherein the hydrogen
2 component comprises NH_3 .

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4 50. The plasma etching method of claim 47 wherein the hydrogen
5 component comprises H_2 .

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7 53. The plasma etching method of claim 47 wherein the first and
8 second plasma etchings are conducted at subatmospheric pressure, and
9 the wafer remaining *in situ* on the electrostatic chuck intermediate the
10 first and second etchings, and maintaining the chamber at a
11 subatmospheric pressure at all time intermediate the first and second
12 plasma etchings.
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1 54. A plasma etching method comprising:

2 positioning a semiconductor wafer on an electrostatic chuck within
3 an inductively coupled plasma etch chamber, the semiconductor wafer
4 having a photoresist layer formed on an insulative oxide layer, the
5 photoresist layer having contact opening patterns formed therethrough;

6 first plasma etching contact openings within the insulative oxide on
7 the semiconductor wafer through the contact opening patterns formed in
8 the photoresist layer with a gas comprising carbon and fluorine, a
9 polymer comprising carbon and fluorine forming over at least some
10 internal surfaces of the plasma etch chamber during the first plasma
11 etching; and

12 after the first plasma etching and with the wafer on the
13 electrostatic chuck, providing the electrostatic chuck at ground or floating
14 potential while second plasma etching using a gas comprising an oxygen
15 component and a carbon component effective to etch photoresist from
16 the substrate and polymer from chamber internal surfaces, and gettering
17 fluorine liberated from the polymer during the second plasma etching
18 with the carbon component to restrict widening of the contact openings
19 formed in the insulative oxide resulting from further etching of the
20 material on the semiconductor wafer during the second plasma etching.

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22 55. The plasma etching method of claim 54 wherein the gettering
23 comprises forming a gaseous hydrogen halide from the etched halogen.

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56. The plasma etching method of claim 54 wherein the gettering comprises forming a gaseous COA_x compound, where A is the etched halogen.

57. The plasma etching method of claim 54 wherein the carbon compound comprises a C-O bond.